Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Building A Future

An Overview of Resource Development

Metallic Minerals

Canada

Metallic Mineral Exploration and Development on Reserves

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Un aperçu de l'exploitation des ressources
L'exploration et l'exploitation des minéraux
métalliques dans les réserves

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Introduction

Growth in the Canadian mining industry is stimulated by finding new mineral deposits, exploring them and developing new mines. Mining companies are always looking for new lands to explore. The reserve lands in Canada are an untapped resource.

An inventory of on-reserve mineral potential prepared by the Department of Indian Affairs and Northern Development (DIAND) in 1990 recorded 3,276 "mineral occurrences" on the 2,267 First Nation reserves in Canada. Of these, 770 reserves were identified with precious and base metal potential. A meaningful number of reserves, 184, were classed as "of significant interest", in other words, warranting further examination.

Such activity suggests that it is worthwhile for First Nations to look at the possibility of metallic mineral development on reserve land.

This booklet examines one group of minerals, called metallic minerals, which are usually defined as minerals with a high specific gravity (weight) and a metallic shine or lustre in their appearance.

Metallic minerals are subdivided into two main groups:

- precious metals — the relatively scarce and valuable metals such as gold, silver and platinum; and

- base metals — any non-precious metals, such as copper, zinc, nickel, lead, etc.

For the purposes of this booklet, all naturally occurring minerals and rock, which may contain metallic minerals, are included as possibilities for exploration and development.

DIAND developed this booklet as one in a series, entitled *Building a Future: An Overview of Resource Development on Reserves,* in response to requests by First Nations for information on developing natural resources on reserves. Designed as information booklets rather than textbooks, each looks at the development of a different resource from the point of view of a First Nations community. Is development a choice? If so, what is the best way to plan and benefit from that development? *Metallic Mineral Exploration and Development on Reserves,* the first booklet in the series, provides an overview of issues associated with mineral rights, exploration, development, environmental concerns, benefits and costs of developing metallic mineral resources. It also discusses the development of policy relating to the mineral industry.

Development Policy and Metallic Minerals

Why Should You Establish a Development Policy?

Development of a non-renewable resource, such as metallic minerals, or even the consideration of development, is easier with a community development policy already in place. It gives your community the guidelines for investigating resource development; it provides for informed decisions on whether to proceed; and it helps maintain a focus on the priorities of your community for investment of both time and money.

A development policy not only provides direction in dealing with the unexpected, it is its own road map, guiding those who will be implementing it on behalf of your community.

The need for a policy begins with your community's decision to pursue economic development. It helps to establish:

- the terms, conditions and limits of development;
- the extent to which economic development is a community priority;
- which development opportunities to study first;
- how to reconcile economic interests with environmental, social, cultural and traditional ones; and
- land-use plans.

When a mineral opportunity arises, be ready to act. With a policy already in place to guide you, you are prepared for each stage of investigation, exploration and actual development. A policy supported by the community will allow you to give a clear message to the potential mining developer.

A written policy, prepared in advance, is best, rather than a verbal one. There is much less chance for misunderstanding later on.

The second important point about a community development policy, probably the most important, is that it should be built through community participation. If your band members have been consulted on its formation, they are more likely to approve and support it.

About Metallic Minerals and Your Community Development Policy

The following table lists many of the metallic minerals produced in Canada. Some, such as platinum and molybdenum, are extremely rare but others, such as nickel and iron ore, are plentiful. They are used in a variety of manufactured products.

1991 PRODUCTION OF LEADING MINERALS IN CANADA

Commodity	Production (000)	Value ($000)	Main Use(s)
Copper (kg)	780,362	2,112,152	Electrical transmission, water tubing, castings, heat exchangers
Gold (g)	176,126	2,349,872	Jewellery, monetary exchange
Iron ore (mt)	35,421	1,228,188	Iron and steel for vehicles and household appliances etc.
Lead (kg)	248,102	210,886	Motor vehicle batteries, solder
Molybdenum (kg)	11,439	65,928	Alloying agent
Nickel (kg)	188,098	1,807,619	Alloying agent
Platinum (g)	11,123	150,155	Automobile catalysts, jewellery
Silver (kg)	1,312	187,676	Photography, jewellery
Uranium (kg)	8,162	595,467	Nuclear power
Zinc (kg)	1,083,008	1,585,167	Alloying agent most commonly used to make brass, galvanizing steel

g — gram kg — kilogram mt — metric tonne

Source: Canada. Department Of Energy, Mines and Resources, 1991.

Is the development of metallic minerals an option for your community? Consider the following questions.

- Does your reserve have mineral deposits to develop?
- In your region, what are the regulatory and legal issues with regard to metallic minerals?
- As a First Nation are you willing to surrender metallic mineral rights to Her Majesty and necessary surface rights as a prerequisite for exploration and development? (See the later section "Understanding the Regulatory Process" for an explanation of the surrender process.)
- After initial exploration, and after you have looked at the benefits and costs, will you want to continue development?

Answers to these questions will form part of your development policy.

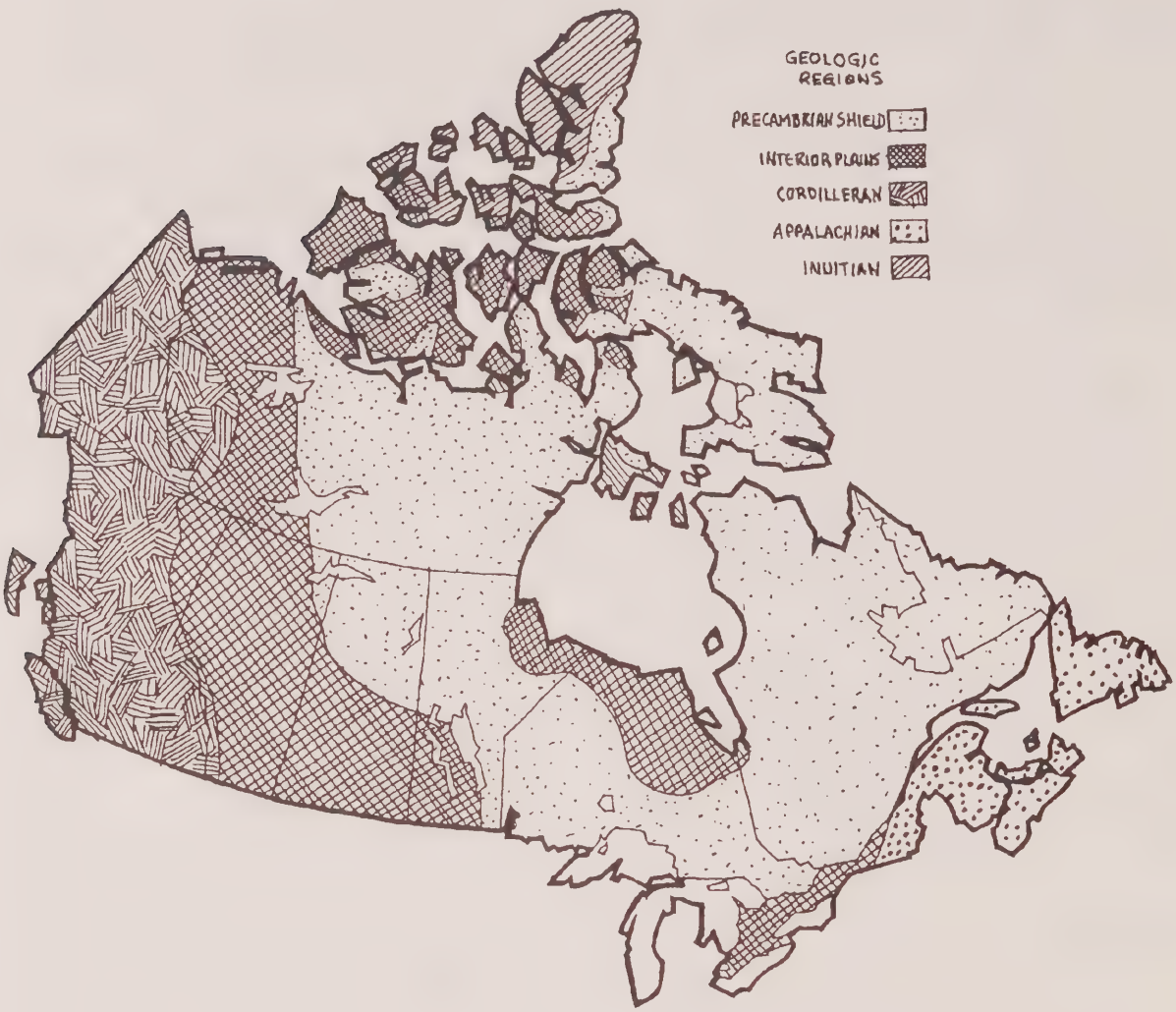
Does Your Reserve Have Mineral Deposits to Develop?

Canada has five basic geological regions, each with particular types of mineral deposits and varying degrees of mineral activity. Which region your reserve is in determines the probability of finding metallic minerals.

- The Precambrian Shield extends across the Hudson Bay area and throughout central Canada. One of the most productive mining regions in the world, the Shield yields everything from iron ore to gold and base metals.

Does your reserve have mineral deposits to develop? As a starting point for your research, check your reserve's potential for metallic minerals in DIAND's inventory report, Mineral Resource Potential on Indian Reserve Lands.

- The Interior Plains region, west of the Precambrian Shield, is, for the most part,unfavourable for metallic minerals.
- The mountainous Cordilleran Region of western Canada contains large deposits of base metals and gold and accounts for half of all mining and exploration in Canada.
- In Atlantic Canada, the Appalachian Region has one of the largest zinc deposits in Canada, the only significant tin deposit in North America, as well as other base and precious metal deposits.
- The Arctic Region, which includes all of Canada's high Arctic, has rich deposits of metallic minerals.



The five basic geological regions of Canada — Which region your reserve is in determines the likelihood of finding metallic minerals.

As a starting point for your research, check your reserve's potential for metallic minerals in DIAND's inventory report, *Mineral Resource Potential on Indian Reserve Lands*. Keep in mind that a low rating does not necessarily rule out mineral development, nor does a positive rating guarantee it. Look at previous studies of your reserve as well; DIAND regional offices have copies.

Talk with other First Nation communities. Many Aboriginal people have taken prospecting courses, explored for minerals or have worked in the mining industry.

Past and current exploration and mining activities on lands near your reserve can be an indication of mineral potential on your lands. They are worth investigating.

Inquiries from the mining industry about access to First Nation lands can indicate interest by developers. Often, companies and prospectors working on nearby off-reserve lands will inquire about access to reserve lands. These inquiries, or their absence, are another indicator of on-reserve potential.

Provincial governments keep records of the results of private-sector mining activity and of past geological exploration. They often have a good overview of opportunities for development in your area.

You can get geological maps, reports and other informative materials from provincial government offices serving the natural resource and environment sectors, and from the Geological Survey of Canada of Natural Resources Canada which has offices in most major cities. Some bookstores as well as public and university libraries carry government publications including geological and other mineral reports.

In Your Region, What Are the Regulatory and Legal Issues With Regard to Metallic Minerals?

Reserve lands are federal Crown lands set aside by law "for the use and benefit of a band." However, this does not necessarily include minerals. Ownership of minerals, or mineral rights, differs from one reserve to another, and from region to region.

First of all, unless otherwise stated, minerals are owned by either the federal or provincial Crowns. If this is not the case for your reserve, it will say so in the Privy Council Order which established your reserve. Ownership of mineral rights may also be determined by other legislation and treaties.

First Nations have significant control of exploration and development of minerals on their lands within the terms of the *Indian Act*, DIAND policy and other legislation.

Areas in which First Nations are entitled to full economic benefit from metallic minerals on their reserves under the *Indian Act* are:

- Reserves created before 1930 in Alberta, Saskatchewan and Manitoba;
- Yukon and the Northwest Territories.

Regions where there are specific controls or factors in addition to the *Indian Act* are:

- British Columbia;
- Reserves created after 1930 in Alberta, Saskatchewan and Manitoba under the Natural Resources Transfer Agreement (*Constitution Act*, 1930);
- Ontario;
- Quebec (where the province claims mineral rights);
- Nova Scotia;
- New Brunswick;
- Newfoundland; and
- Prince Edward Island.

DIAND regional offices can give you the particular details affecting your reserve.

Even if you do not hold the rights to metallic minerals underlying your reserve, the surface of the land is still under your authority. This gives you control over most development.

Note too that First Nation rights to minerals can be changed through federal-provincial/territorial negotiation. If it appears that a potential change might improve your rights, you could hold off on mineral development until such change has occurred. In Quebec, where there is no agreement between the federal and provincial governments, bands may negotiate directly with the province.

The Question of Surrendering Metallic Mineral Rights as a Prerequisite for Development

The *Indian Act* requires that a First Nation surrender to Her Majesty any rights to metallic minerals underlying a reserve, if development is to take place. (See the later sections "Understanding the Regulatory Process" and "The Implications of Metallic Mineral Development," for more information on this issue.)

Look at the Benefits and Costs of Metallic Mineral Development

Before you make any decisions, consider the advantages and disadvantages of mineral development for your reserve. It takes place in four stages.

- **Exploration**:
  - location of potential mineral sites;
  - confirmation of the existence of minerals;
  - assessment of the quantity and quality of the deposit;
  - development of an extraction plan; and
  - feasibility study of a mine.

- **Development:**
  - construction;

- **Production**:
  - operation of a mine; and

- **Mine rehabilitation**:
  - restoring the mine site as much as possible to its original state.

Benefits and costs depend on the extent of your involvement and at what stages. There is a misconception that the only way to obtain benefits from minerals is to mine them. In fact, mines are rare — maybe one in every 2,000 mineral occurrences ends up as a producing mine. But the exploration stage can bring its own economic benefits, the most obvious being jobs and training for individual First Nations people on the reserve which is being explored.

Benefits

In 1990, between $750 and $850 million was invested in mineral exploration in Canada. These dollars were spent on salaries, equipment, surveys, drilling, transportation, map making, laboratory analyses and hundreds of other activities for the purposes of finding minerals.

When the exploration takes place on a reserve, the First Nation can share in the benefits. Besides employment and training, other direct and indirect benefits include:

- bonus payments or royalty pre-payments which are paid regardless of whether exploration or mining occurs;
- rents related to the surface area to be explored;
- machinery rentals and heavy equipment maintenance;
- transportation and hauling;
- new roads, bridges or other construction;
- accommodation;
- catering; and
- retail sales.

If the exploration does result in the discovery of an economically viable mineral deposit, your community could expect the following benefits.

- The sale of minerals produces royalty income, the amount of which depends on:
  - the volume of processed minerals produced;
  - the royalty rate you negotiate with the project developer. The rate would reflect prices, volumes and the developer's ability to pay; and
  - your right as a First Nation to royalty income. Depending on the federal-provincial ownership agreement in place, your royalty could range from none at all to 100 percent.
- Surface rents are paid to a First Nation for the use of the reserve land surface for the mine and access roads. Rents are calculated according to the local market values of land and the size of the area needed for the mining operation. It is of mutual benefit to you and the developer to negotiate fair rents because overly high rents add to the mine operator's costs and reduce profitability. This in turn will affect the First Nation's financial benefits. Paid on a per hectare basis, rents at the moment range from $5 to more than $300 per hectare. Surface rights may have to be designated for the duration of the project.

Royalties and rents are paid to the Receiver General for Canada and deposited into the First Nation's trust accounts. Royalties are paid into your Capital account and rents into the Revenue account.

- Employment and training opportunities could result for band members in professional areas such as business, land management, geology, engineering and other related fields. For skilled workers, there could be opportunities in mining and heavy equipment operations.

- Other direct income might be tax revenues. As a First Nation, you have the authority to pass by-laws to impose taxes under section 87 of the *Indian Act*.

- Infrastructure benefits could include new road construction, access to electric power sources and access to services brought in to the mine.

Associated Costs

The environmental impacts associated with mining can be significant. Exploration usually includes temporary drilling programs, construction of access roads for heavy equipment and noise and pollution caused by heavy machinery and vehicles. At the development stage, the impact on the environment is generally greater than at the exploration stage; the degree of impact depends on the type of mining.

In open pit methods, environmental problems could include:

- the removal of large amounts of soil and rock;

- pollution of ground and surface water;

- noise;

- erosion during operations and after rehabilitation;

- land use conflicts;

- deterioration of permafrost;

- destruction of trees, vegetation, habitat for wildlife and fish, and other unique physical features;

- deterioration of the attractiveness of surroundings;

- the risk of injury and accident;

- health and safety of workers;

- heavy truck traffic;

- dust; and

- damage to community roads.

Other than the surface elements of underground mining, such as the shaft, mill, tailing pond and waste material, deep mining is less destructive to the environment.

Even though a mine doesn't generally use a lot of land, large-scale mining produces waste material both from the mine itself, in the form of unwanted rock, and from the milling and concentrating processes. In some cases millions of tonnes of waste are produced over the life of a mine. When the mineral deposit is depleted, whatever waste cannot be returned underground or put back in the open pit is usually left on the surface to be dealt with during the rehabilitation phase.

When exposed to air and water, some rocks and minerals may release natural chemicals, such as arsenic and sulphur. When rain water combines with the chemicals, the result is a process called "acid mine drainage." A major environmental problem in the past for mine sites and surrounding land, these

discharges can now be controlled by new technological methods.

The easier access into the reserve provided by new roads can increase the problem of trespassers or provide your community with improved access to previously inaccessible areas.

Summarize Your Findings

It is not easy to assess the benefits and problems associated with mineral exploration and development. You might consent to exploration on your reserve because it generates some benefits at relatively little environmental cost. But you might not like the environmental costs of the development stage. The construction and operation of a mine may bring greater financial benefits, but at what price? Some First Nations feel that the environmental and social impacts are not worth it. However, if you agree to exploration, be prepared for development if a deposit is found.

If you have confirmed that your reserve has mineral potential, consider two issues. Is your community willing to surrender its mineral rights to Her Majesty? Are the benefits of exploration and mining on your land greater than the potential environmental risks?

If the answer is no to both questions, then put the idea aside. You have not wasted your time in looking at the possibilities of mineral development on your reserve. Rather, you may have saved a great deal of time and money by eliminating the option at the beginning rather than attempting to abandon it somewhere in the middle of the process later on.

It is still a good idea to record the location of your on-reserve mineral deposits on land use plans. By ensuring that nothing is built over them and that the land is not allocated for other purposes, you are keeping your options open for future development.

If the answer is yes to both questions, add metallic minerals as a resource to be included in your development policy. The groundwork is done. Now for the specifics.

Activities related to exploration for metallic minerals are expensive and require a certain level of technical knowledge.

Mining companies are in the business of finding new deposits. Their expertise and access to funding are the resources used to search for evidence of a metallic mineral from the basic exploration stage through to mine development.

Often, First Nations do not have access to the large amount of funding necessary for exploratory activities: preliminary diamond drilling, geophysics and geochemical surveys.

Your community may decide to conduct preliminary exploration work, sufficient to attract a mining company. Favourable results from the exploration would give you an advantage in negotiating an agreement with a mining company — one in which you could increase and specify the benefits to your community.

Even so, it is the First Nation's responsibility to be informed and to understand all aspects of the process, especially the issues surrounding mineral rights, environmental impacts and the implications of the various stages of the metallic mineral activity. It is highly advisable for First Nations to seek professional advice before carrying out expensive exploration.

Exploration and Development of Metallic Minerals

Understanding the Regulatory Process

Surrenders

First of all, it is against the law to remove minerals from a reserve without the permission of the Minister of Indian Affairs and Northern Development or the Minister's representative.

Since a reserve is set aside for the use and benefit of each and every band member, the surrender process is required by law to delegate the decision-making authority to Her Majesty on the community's behalf.

For a First Nation to initiate mineral activity on its reserve, it must first surrender its mineral interests to Her Majesty. Mineral rights can then be negotiated for sale to third parties for the purposes of mineral exploration or development.

A surrender means a First Nation surrenders its mineral interest so that the Minister can deal with that interest, as consented to by the First Nation. This interest could include the exploration, development and sale of metallic minerals.

For a surrender to be valid, the following elements must apply:

- it is made to Her Majesty;
- it is consented to by the majority of band members; and
- it is accepted by an Order in Council.

Sometimes, when the mineral rights are surrendered, the development and administration of these minerals is determined by the province.

Permits and Leases

When the federal Crown manages the surrendered rights, the *Indian Mining Regulations* provide the framework for the disposition of surrendered mineral rights to third parties (mine developers). Disposition can occur through a tendering process. When this happens, the highest bidder is selected. Disposition can take place under terms and conditions approved by the band council.

The *Indian Mining Regulations* permit DIAND to carry out a disposition using permits and leases to third parties. The Regulations also outline the process for approving leases and permits and determining their content.

A permit is a legal contract which outlines the obligations of a permit holder when prospecting, exploring or developing mineral deposits on First Nation lands. A permit does not convey the rights to the land or any mineral found on or in the land, but may give exclusive rights to the permit holder to select a portion of the permit area for leasing purposes.

Permits are frequently used to authorize the exploration of large tracts of land. A permit is issued for no more than one year, subject to three extensions of no more than one year each. A maximum of three further extensions may be granted to complete exploration work.

A lease is also a legal contract. It identifies the terms and conditions for exploration, development and production of minerals on First Nation reserve lands. A lease is granted for a 10-year period (unless otherwise specified). It may be renewed for additional periods of 10 years providing minerals are being produced.

With any other form of advance exploration or development, a lease should be issued. It protects each party's interest until a final decision is made on additional work; it gives you greater flexibility in anticipating future exploration or development work; it provides the financial security necessary for the private sector to feel comfortable investing large sums of capital; and it helps structure a better agreement for the participating parties.

Environmental Assessments

Before granting a lease or permit, DIAND is required to conduct an environmental assessment and screening under the Environmental Assessment and Review Process (EARP). To do this, DIAND will ask the developer to provide an operation and restoration plan. The plan accompanies permit and lease applications, and provides the information DIAND uses to conduct environmental impact assessments before exploration or development begins. Operation and restoration plans include the technical results of studies performed by environmental experts on lands affected by mineral development.

A Mineral Disposition Checklist

Understanding the mineral disposition process may be useful if you decide to go ahead with mineral activity. The following points highlight the relevant issues.

- **Disposition of mineral rights**: Does the disposition process apply to your reserve?

- **Federal or provincial involvement**: If so, would surrendering mineral rights invoke provincial involvement? Would you be sharing royalties with the provincial Crown?

- **Time and money for a referendum**: Have you allowed enough time to get the assent of your First Nation, and enough money to communicate the issues and alternatives to everyone?

- **Advantages of a surrender**: A surrender would allow you to impose conditions on the Crown. For instance, if rights are surrendered to Her Majesty, you can decide whether the mineral rights will be offered through public tender with the lease or permit issued to the bidder with the best offer. However, tenders work only where there is significant third-party interest in the mineral rights. Companies are encouraged to compete with each other to provide First Nations with the best deal. If there is only one company

interested, the tendering process won't work. Then it is in the best interests of the First Nation for DIAND to issue a permit or lease directly to the interested company, being careful to ensure that it represents both fair and acceptable market value. In either process, First Nations are directly involved with DIAND in the planning and decision making.

- **DIAND's concerns in the surrender process:** DIAND tries to ensure that First Nation decision makers have access to all the information typical in industry decisions of similar size.

- **If the developer is a band-owned corporation**: The surrender/lease/permit process must still be followed. In such an instance you would compare the band corporation option against non-band options before making a choice.

- **Lease or permit**: Since a band council and developer can choose either a lease or permit, consider which would suit your band. A permit is preferable when the developer wants to gather geological information over a large area quickly and is confident about securing a lease for smaller areas if minerals are found.

- **Band Council Resolutions**: Take advantage of your band council's authority to approve the terms and conditions of a lease or permit under section 6(1) of the *Indian Mining Regulations*. Approval is accomplished through a Band Council Resolution (BCR). A good BCR protects the First Nation by stating exactly the authority of DIAND and the obligations of the permit or lease holder. The terms necessary at the exploration stage will differ from those necessary at the development, operation, production and rehabilitation stages. Exploration companies may be technically unable to carry out later development and may not want to negotiate the whole arrangement, especially when the prospect of mine development is remote. If this happens, a two-stage process is advisable. The first stage deals with the terms and conditions necessary for exploration and sets the guidelines for negotiating the terms and conditions for development.

  Since reserve land will be competing with off-reserve land for the developer's money, developers will go elsewhere if they cannot reach an acceptable deal. The challenge for First Nations is to know how to maximize the potential benefits in the negotiations without discouraging the developer.

- **Relations between the developer and local residents:** Encourage the developer to talk to local residents to get their views and concerns. Without community support for the project, a mineral proposal could be seen simply as an environmental threat. In many cases this could be an unfounded concern that could threaten the project's success.

- **Environmental concerns:** To ensure protection of the environment, tell the developer and DIAND at the planning stages of the project what environmental issues you want covered.

The following elements affect an on-reserve mineral operation.

GENERAL PROVISIONS

- obligations required under the *Indian Act* and the *Indian Mining Regulations;*
- security deposit in the form of money, bonds or promissory notes payable to the Receiver General as outlined in the Regulations;
- obligations to ensure that the developer observes all provincial and local laws relevant to the operation;
- duration - the start and end dates including day, month and year;
- land description - an accurate legal description of the boundaries of the land area and a survey plan or sketch;
- minerals to be mined, including amount and type of material to be mined;
- dealing with unforseen events such as accidents, disagreements, insolvency and defaults; and
- special conditions which address specific concerns not identified elsewhere.

EXPLORATION STAGE

- social, environmental and exploration concerns of the band and DIAND;
- rents and bonuses, if any, and the conditions of payment, fees and interest payable;
- a company's proof of liability insurance;
- a company's proof of security deposit or performance bond;
- an Affidavit of Execution;
- assessment work requirements or payment in cash of an amount equal to value of assessment work required;
- operational plan with a detailed description of the types of geotechnical surveys, samplings or core drilling to occur in the area including cutlines, new trails or roads and drill sites; and
- compensation plan giving a detailed description of financial restitution for band members to cover any property damage attributed to exploration.

MINE DEVELOPMENT, OPERATION, PRODUCTION AND REHABILITATION

- social, environmental and mining concerns of the band and DIAND;
- royalties, rents and bonuses, if any, and the conditions of payment, fees and interest payable;
- a company's proof of liability insurance;
- a company's proof of security deposit or performance bond;
- an Affidavit of Execution;
- assessment work requirements or cash payment of an amount equal to value of assessment work required;
- operational plan outlining detailed description of the mine;
- compensation plan giving a detailed description of financial restitution provided to band members for any property damage attributed to mine development, operations and shut-down; and
- an operational plan outlining the activities of the development, mining and rehabilitation process.

- **The environmental assessment**: Check the criteria of DIAND's proposed environmental assessment. Create a rehabilitation plan.

- **Implementation**: Monitor the implementation of the lease or permit. If you are not satisfied, talk to DIAND's lease or permit manager.

- **Verify payments**: Money paid by the developer to DIAND should correspond with the amount owed under the lease or permit. Make sure money collected by DIAND is deposited to the right account.

Once the question of mineral rights is sorted out, the next step is an investigation of the actual process of exploration and mining and its implications for your community.

Understanding the Minerals Business

Success in the mining business is a combination of luck, hard work and a firm understanding of the industry and its practices. Talk to people who work in both exploration and development. Build on their experience to support your community's approach.

Before mineral activity can proceed, a developer must secure the mineral rights to the land where exploration is to take place. These rights are granted, on particular terms and conditions negotiated with the band, together with DIAND.

An important consideration for developers is the up-front financial commitments: they are expected to pay rent to holders of surface lands where they intend to explore or mine, they pay a royalty to the province or territory based on the amount of mineral mined and often they must pay municipal taxes.

Exploration

Exploration is the search for and measurement of minerals in their natural state. Only when the developer knows a mineral deposit's location, size, composition and quality can the decision be made whether to proceed with development.

First, geologists identify large active mineralized regions, eliminate the unproductive ones and focus on smaller productive areas. More expensive and complex exploration methods are used on these smaller areas to locate specific minerals. This determines if a particular site should be explored further with test drilling or chemical analysis.

The stage-by-stage approach to exploration is a way of minimizing the costs of what is usually an expensive undertaking. At each stage, developers can reduce their land holdings, and therefore their costs, if the survey results are negative. This is an important point, especially since exploration costs increase at each stage, and so few mineral occurrences actually result in the development of a mine. It is difficult to estimate costs since conditions vary with each exploration program, but the following table provides a general estimation of costs by stage.

COSTS OF EXPLORATION STAGES*

Exploration Stage	Cost Range	Time Required
Stage I - Literature Review	$1,000	Weeks
Stage II - Field Surveys	$50,000	Months
Stage III - Geoscientific Studies	$1 million	1 - 3 years
Stage IV - Drilling	$1 - 5 million	2 - 4 years
Stage V - Feasibility	$1 million	1 - 2 years

* Note: All figures are approximate.

Exploration for metallic minerals has five stages:

- literature review;
- field surveys;
- geotechnical studies;
- drilling programs; and
- market and feasibility studies.

Stage I: Literature Review
A literature review is a first assessment of all existing information about a specific reserve including its geology, mineral potential and history. Provincial ministries of mines and natural resources, Natural Resources Canada and the Geological Survey of Canada can all provide information. After reviewing the literature, geologists can decide which areas to look at more closely.

Stage II: Field Surveys
Focusing on the favourable sites identified in the literature review, geologists next conduct field surveys to determine a property's mineral potential. To begin, they take samples from mineralized outcrops of the area. These are rocks that are part of a formation, not loose boulders, and that are visible from the surface. This sampling and analysis (assaying) will indicate the type, nature and characteristics of the formation, including the minerals present. Sometimes a few outcrops are enough to give a clear picture of the mineral deposit and geology of the area.

After the samples are tested, labelled and recorded with a brief description of the location and its geological features, chemical tests — assays — are conducted. All the information is plotted on a map showing the locations of sample sites.

Examining rock samples for metallic minerals. This sampling will indicate the type, nature and characteristics of the formation, including the minerals present.

More specific clues also help to locate minerals.

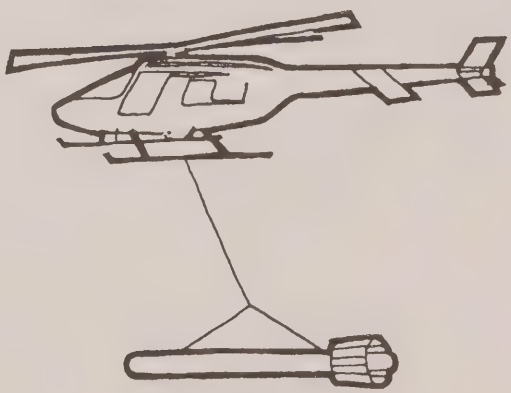
- Rust (Gossan) - Rust-coloured rocks or soil are one of the best indications of mineralization. Rust is caused by iron which may indicate the presence of other metallic minerals. A variety of rust-coloured minerals exist. Copper sulphide is identified by green or blue stain, nickel sulphide by a pale green stain and uranium minerals may weather to bright yellow, orange or green.

- Quartz - Most sulphide mineral deposits are associated with quartz veins. Unless visible, gold and silver cannot be definitely determined without an assay test but other metals such as copper, lead and zinc may be identified without an assay.

- Dykes - These are long thin bodies of igneous rock that, while in a molten state, flowed into cracks in older rocks. They stand out from the rock they flowed into and frequently contain or are associated with valuable minerals.

- Shear zones - A shear zone is a place of weakness or a break in the earth's crust through which mineralized solutions may have been channelled. From the air, they appear as long depressions or lines. Since they often contain quartz veins, they are a likely location of metallic minerals.

Some types of geophysical surveys are used in field surveys to investigate large areas at low cost. For example, airborne magnetic, electromagnetic (EM) and radiometric surveys can pinpoint promising areas to be studied in more detail on the ground.

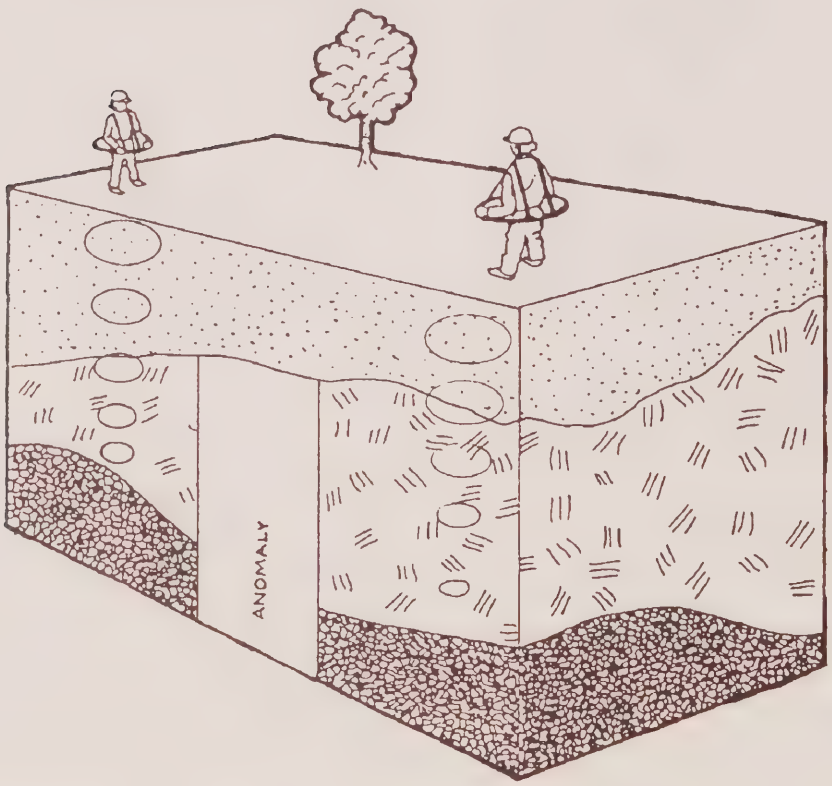


An airborne magnetic survey can cover large areas and pinpoint promising targets (anomalies) to be studied in more detail on the ground.

In one type of geophysical survey, the earth is viewed like a giant magnet. Highly magnetic mineral bodies include deposits of magnetite and certain iron sulphides often associated with base and precious metals. Such bodies cause a distortion in the direction, inclination and strength of the earth's local magnetic field, a distortion that can be detected and measured through electromagnetic surveying. Because they enable geologists to measure the size and location of buried minerals with such precision, electromagnetic (EM) surveys are the most important geophysical survey method used today.

Geologists use another type of survey in areas where radioactive elements are known to be present. By measuring the amount of energy released during radioactive decay, geiger counters, scintillometers or the more sophisticated gamma-ray spectrometers can detect metals such as uranium.

These are the more common forms of geophysical exploration methods used in metallic mineral surveying but there are many others. Their use depends on the terrain, mineral types and geological conditions.



Anomalies picked up in airborne surveys are confirmed on the ground by various geophysical survey methods, in this case, the electromagnetic method.

If field surveys do not confirm the presence of minerals, exploration may be abandoned. And at least for mineral activity, the value of the property being surveyed will probably decline.

Stage III: Geoscientific Studies
If the field surveys are positive, the next step is a closer examination of the most promising sites. At this stage, techniques include geological mapping, geochemical surveys, test drilling and sampling and more detailed geophysical surveys using much closer sampling points. The geophysical surveys of Stage III exploration are rather like using a fine tooth comb over the area as compared to the broad brush approach of the surveys in Stage II. They focus on smaller areas for greater accuracy, although at greater cost.

In geological mapping, grids are used to control the survey location. Parallel straight lines are cleared through the bush in a crisscross pattern over the ground to be surveyed. The baseline is cut first to run parallel with the main directional feature of the rock formation, called the "strike," or the direction of the magnetic or conductive zones. Cross lines are then cut out from the baseline at regular intervals of 30, 50 or 100 metres to ensure that no mineral deposits are missed by falling between the survey lines.

Pickets or stakes are spaced along the cross lines to provide preselected points from which to take instrument readings and orient the mapping. Readings are then plotted to locate the areas for diamond drilling testing. High metal concentrations can now be tracked anywhere in the grid, even in lake or stream sediments, ground or surface water as well as the more accessible sources such as rock outcrops and soil. Samples are then sent to specialized mineral laboratories for analysis.

Geochemistry is used to study unusual concentrations of metals on the earth's surface. Geochemical sampling surveys are sometimes used to explore areas that have poor electromagnetic response or thick overburden (a layer of material such as rock or clay over the bedrock).

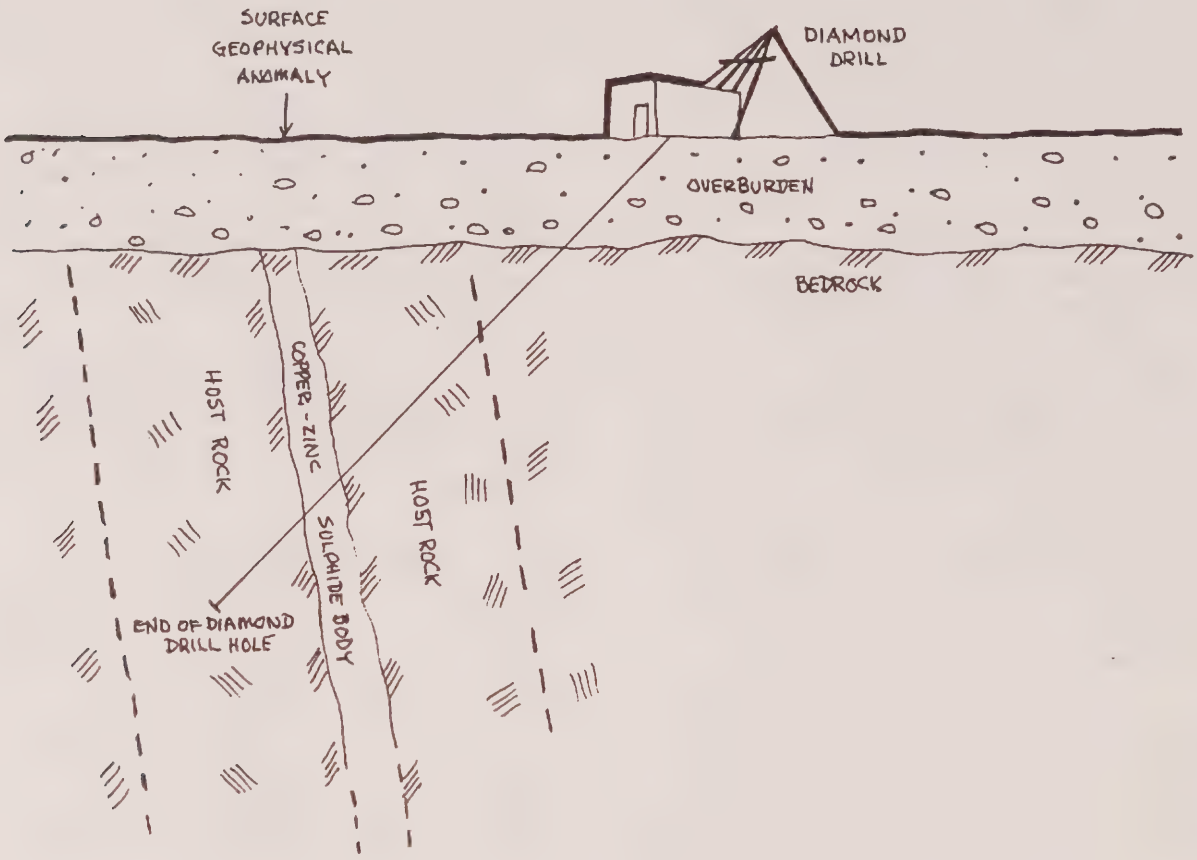
Positive results of these geoscientific studies will increase the value of the property and are grounds for moving on to the next stage of exploration.

Stage IV: Drilling Programs
A diamond drilling program is the next step. This is an expensive process and done only if the results of all the other studies indicate a reasonably accessible concentration of metals. The core samples extracted from below the earth's surface allows geologists to create a three-dimensional picture of the bedrock. Part of the core is also sent for chemical analysis.

If the core tests indicate a significant metallic deposit, more detailed exploration is in order. At each successful testing stage, the market value of the mineral rights is likely to increase.

Stage V: Market and Feasibility Studies
A feasibility study evaluates the size and depth of the ore body and recommends mining methods to get at it. Some studies also predict rates of production. Investigative tools could include close-spaced diamond drilling and perhaps underground investigation.

Feasibility and market studies are usually required by major investors before they will commit funds to the project. It is at this make-or-break stage in the exploration



Diamond drilling enables geologists to extract drill core samples. By examining drill core, geologists can determine rock types, mineralization, and how the rocks lie, dip or fold. This information can be used to create a three-dimensional picture of the bedrock.

process that decisions are made to pursue development or shelve the project until it becomes economically more attractive. Frequently, what had been considered a "hot" property to this point is abandoned when the accumulated evidence shows that the deposit is too small or insignificant to mine profitably at current metal prices.

As with other exploration stages, positive market and feasibility studies enhance the value of the property and related mineral rights. Negative results, however, could mean that all the time and money invested in exploration have led to nothing more than a decision not to proceed. This underlines the importance of strong positive results at each stage of exploration to warrant taking the next step.

These are just some of the factors to be aware of if your community is considering the possibilities of metallic mineral exploration. The individual circumstances of your reserve will of course dictate the progress of exploration.

Mine Planning

If a mineral deposit still shows promise after the increasingly stringent tests of the exploration stage, there is more planning, drilling and feasibility work to be done. With the decision to pursue development of a mine, operational and rehabilitation plans are prepared up-front as planning and control mechanisms.

Throughout the entire process of both exploration and development, the accumulated information on the mineral deposit is continually tested for its chances for success. Evidence of insufficient quantity, too costly an engineering feature, a poor price of the mineral on world markets — any of these elements could bring mine development to a stop.

Confirming the Deposit

The mineralization identified by surface drilling in the preliminary exploration phases is known as "in place," "in situ" or "drill-indicated reserves." Before a production decision can be made, these drill-indicated reserves must be converted into what is known as "ore reserves." This step often requires underground development in the mineral deposit and close-spaced definition drilling from underground openings to confirm ore continuity, tonnage and grade. Only when a mineral deposit can be mined profitably is it called "ore."

Ore reserves fall into three categories: proven, probable and inferred.

A proven ore reserve has been well defined, drilled off with closely spaced drill holes and adequately developed through the use of drifts, raises and crosscuts to establish continuity, grade and tonnage with reasonable certainty. Only proven ore reserves warrant full-scale production.

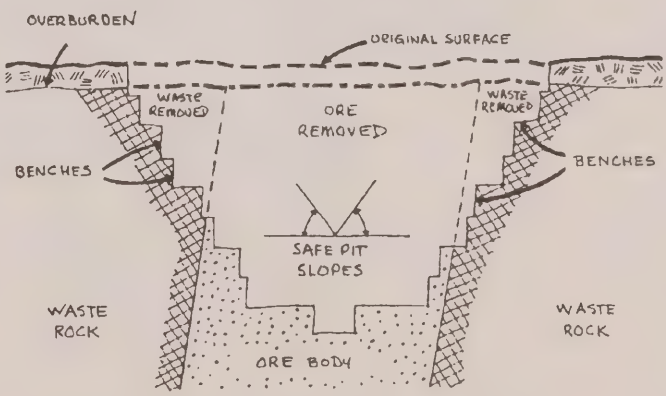
Probable ore reserves need further drilling before they can be confirmed as proven reserves.

Possible, or *inferred ore reserves* are the least explored.

The term "mineable reserves" refers to the tonnage of ore that can be safely and economically recovered. An entire ore body often cannot be mined because of the need for support structures within it to bolster the roof of the mined-out areas. Only the mineable reserves are used to calculate the production grade of the ore that will be delivered to the mill.

Extraction Methods

Operating mines range from small underground operations (100 metric tonnes of ore per day) to large open pits producing thousands of tonnes of ore in a day. The shape and orientation of an ore body, its



A cross-section view of an open-pit mine. Open pit mines are the least expensive method of extracting minerals when the ore body is close to the surface and has very little overburden.

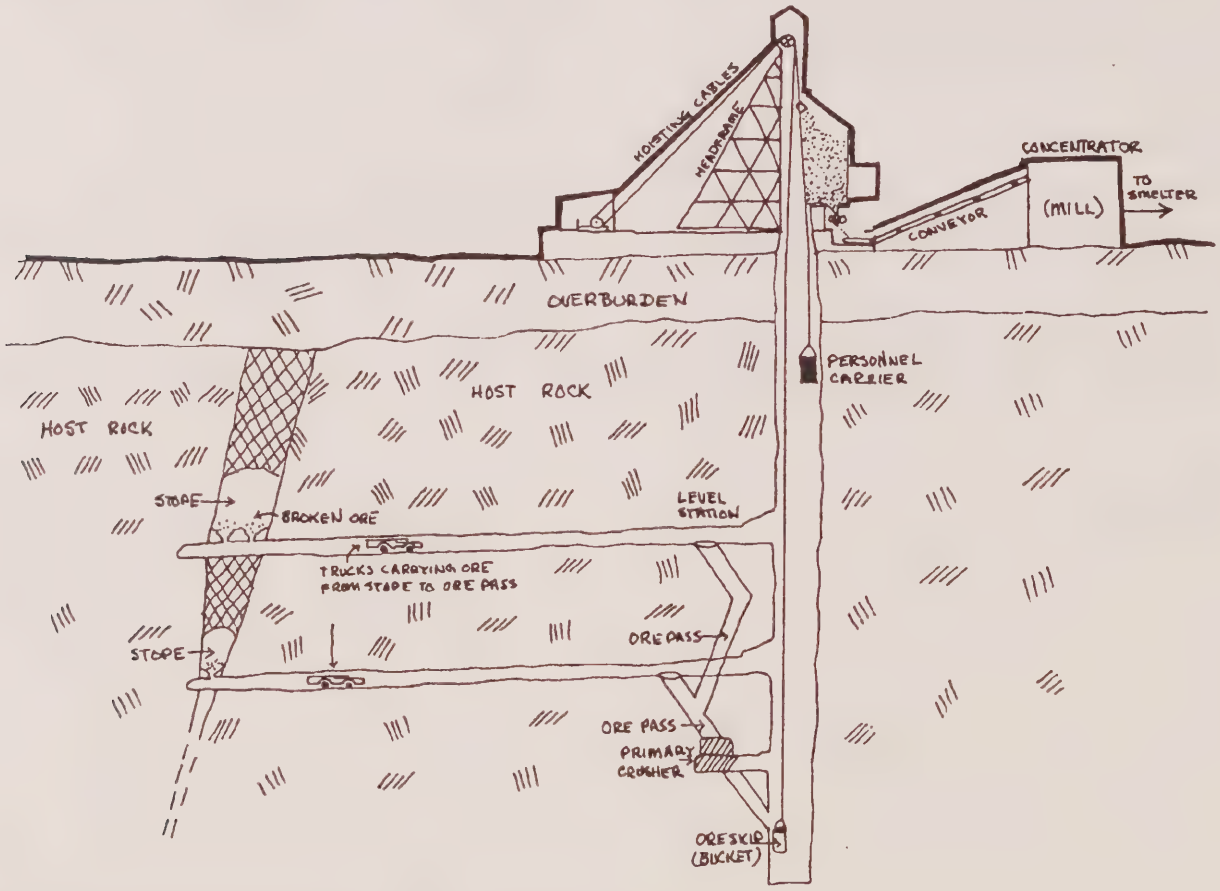
quality, surrounding waste rock and distribution of metallic minerals all influence the selection of mining method.

The most common methods are cut and fill, conventional blast-hole, vertical retreat, room and pillar, shrinkage and sub-level caving. The individual characteristics of an ore body dictate the choice of method. In most cases, holes are drilled into an exposed area of the ore body, the holes are loaded with explosives and blasted. The rubble, or muck, is then removed by machine for processing.

The primary opening into an underground mine provides access for personnel, materials, equipment and a way for the ore to be brought to the surface. It can either be a shaft, a decline (also called a ramp) or an adit (a nearly horizontal entrance).

A shaft is usually vertical and equipped with hoisting systems. Ramps usually spiral downward at a grade of about 15° or less to let rubber-tired mobile equipment move in and out of the mine easily. An adit opens into the side of a hill or mountain and is often equipped with haulage systems.

The cost of bringing a mine through the development phase to production is high. It is common for $100 to $200 million to be spent on construction of openings, roads



Cut-away view of an underground mine. The ore is broken (blasted), loaded, hauled to the underground crusher, then transported to the surface for processing at the mill.

and other mine infrastructure before production even begins. For these reasons, mining operations are often financed by business partnerships and venture capital.

Environmental Assessment

Before construction of a mine can start, an environmental assessment is usually required by law.

Environmental assessments are rigorous, technical and have their own set of criteria. Technical experts should be brought in to conduct them properly. There are environmental consulting firms familiar with all aspects of environmental impact assessment in most major cities in Canada. Environment Canada also has expertise in environmental assessment, as do provincial resource departments.

The costs of environmental assessments vary depending on the size of a project but are normally less than one percent of the total cost of the project.

Processing

Mills or concentrators are large facilities used to recover metallic minerals embedded in an ore deposit. The process is called "beneficiation," the product, "concentrate." In the case of gold and silver, when melted or moulded into a bar, the result is known as an "impure dore bar."

All processing begins with the crushing and grinding of rock — "gangue" — that is scattered within minerals; this is the cleanest, most economical way of separating metallic compounds from the host rock. The ground ore or pulp is then fed through the recovery process which varies, depending on the nature of the metal being mined. All use either chemical or physical means, or a combination of both, to separate metal elements. The most common method of recovery is smelting, which uses heat.

Site Reclamation

Rock waste management is a crucial part of the planning process for a mine. The laws and regulations governing mine rock wastes are designed to minimize their impact on the land and environment.

Reclamation is the rehabilitation of land around a mine site to its original condition before mining began on the property. Its aim is to restore the land to a useful and safe state. Regulations passed in the late 1960s and early 1970s have formally integrated mine site reclamation into the mining process. Today, reclamation studies are an important part of a mine's operational plan as well as the environmental assessment process.

When a mine site is permanently closed, the land must be reclaimed to minimize pollution problems and restored to a useful state. Disturbed lands, open pits, underground workings, waste rock dumps, tailings areas, impoundment ponds, man-made structures and altered or disturbed drainage networks must all be cleaned up and restored.

The Reclamation Process

- Objectives for use of the land after mining is finished are usually incorporated in the mine's operational plan. To ensure success in meeting these objectives, the feasibility study should include tests on regeneration, drainage and slope stability. Early planning also allows for the storage of topsoil and careful placement of wastes to help in the final reclamation.

- After the mine site closes, machinery, equipment and building superstructures must be removed. Concrete foundations and slabs may be left intact if they are covered by overburden and revegetated. All scrap materials must be disposed of safely and openings sealed.

- Waste rock material can be used as backfill in both open pit and underground mines, unless it affects the reclamation process. For example, if waste is toxic or deviates too far from soil conditions normal for the area, another method of disposal must be found. Waste or dump rock can be used effectively to reshape the landscape of the mine site.

- In Canada, most metallic mineral deposits are sulphide ores and contain pyrite. Oxidized mill tailings produced from the extraction of sulphide ores are often toxic because, in contact with water, they produce acid. The resulting tailing ponds can pose problems for mine-site reclamation, but there are ways of dealing with them. The waste water is drained from the pond, the tailings capped with a soil and vegetation cover and the area provided with an adequate drainage system. In this way, oxidation and acidification of ground water are controlled because of the limited contact of oxygen and moisture with the buried tailings.

- Waste water must also be treated before it enters the area's water supply. Radioactive mill tailings from uranium mines are a potential problem because both the radioactivity and the acid-producing sulphides must be contained. Current studies are experimenting with ways of neutralizing the acid-generating sulphides in abandoned tailings.

- With most mines, natural drainage systems have to be diverted from stockpiles including topsoil, subsoil, overburden and waste rock to control seepage. When mine operations stop, the natural drainage system must be returned to normal.

- Stockpiles of topsoil and overburden can be spread over the site with bulldozers to reduce steep slopes. This encourages the re-establishment of grass, trees or crops and makes the area safe for wildlife. Generally, the developer is responsible for seeding or further landscaping of the site. In many parts of Canada, reseeding will happen naturally.

The Implications of Metallic Mineral Development

Metallic mineral development is a long, expensive process. If you are considering development, either yourselves through a band-owned corporation or through an outside developer, the following points are relevant.

- If your First Nation decides to explore for minerals itself, via a band-owned corporation, you must surrender the mineral rights.

- Decide how much exploration to carry out directly with your own funds. If exploration is successful, the value of the property increases, and will be more marketable to a mining company. Negative results will diminish the value of the property in terms of mineral potential, and you will get little return on your investment.

- The cost of mineral exploration and activity increases at each stage from initial research through to development. While many First Nations can afford to carry out the literature research and field surveys, later stages become increasingly expensive. Eventually the high cost of development would probably require First Nations to seek the resources of a private sector company for further development.

- The marketplace for mineral rights and mineral properties is very aggressive. Competition is fierce for the money and resources needed to explore all the "hot" mineral prospects in Canada, and, increasingly, around the world. Many people and companies option, buy, sell and speculate on properties with no intention to explore themselves. To take advantage of the opportunities available, First Nations have to compete in this open market. Rarely will developers line up outside your door and beg to be allowed to risk large sums of money to explore and develop your property. They will only be enticed with sound arguments, accurate and detailed information and a businesslike approach.

  Another consideration: most off-reserve development work is carried out under clearly defined provincial and territorial mining acts and regulations. Developers are familiar with working off-reserve and, to some extent, may prefer to work there. In such a marketplace, efficient promotion and negotiation help immensely.

- Mineral activity near your reserve tends to enhance the value of on-reserve mineral rights.

- In most instances, you as a First Nation will receive royalties and surface rent payments from development on your reserve. As a First Nation, you may raise funds through taxation, whereas in off-reserve situations, these funds accrue to local governments. Finally, First Nations will often be able to negotiate with developers for employment, training and business opportunities.

Launching the Process

You have established metallic mineral potential on your reserve; your development policy supports metallic mineral exploration; and your community has given your band council the go-ahead to proceed. Now a mineral development strategy becomes the important next step. It should reflect the specific situation facing your First Nation.

Two situations, one at either end of the spectrum, illustrate the available options.

In the first example, there is considerable private sector interest in mineral development on your land. Mineral development companies have approached you about potential projects as a result of positive exploration results in nearby lands, favourable geological structures on your reserve or deposits which begin off-reserve and pass under your lands.

In this example, you could invite the developers to submit offers. You would define the issues which might include royalty payments, surface rents, infrastructure development of benefit to your community, environmental protection, site rehabilitation and the role of a band-owned corporation.

As a First Nation, you would select the most promising company offer and proceed to negotiate development terms and conditions which would ultimately be incorporated into the surrender of mineral rights.

In the second example, there is no private sector interest in your land. No developers are coming forward, even though you believe there is development potential. In this situation, you could simply wait for interested parties to appear or you could seek them out. You could:

- allow a band organization to carry out exploration directly, using First Nation resources. If the results are encouraging, you could use them to promote the property and increase its value. (Important to note here that exploration becomes increasingly expensive at each stage and negative results could kill the development and generate no benefits for the First Nation.);

- surrender your mineral rights on terms and conditions which compare favourably to those for off-reserve lands;

- contribute financing to the project through a band-owned corporation, by negotiating a joint venture arrangement between the corporation and the developer; and

- launch an aggressive promotional campaign aimed at potential developers. The campaign could include advertisements in mining newspapers, the development of promotional materials and extensive personal contact.

These examples illustrate how you might promote your project:

- carry out exploration using band resources;

- study the terms and conditions of leases and permits to be signed with the developer;

- make contributions to the project through a band-owned corporation; and

- an aggressive information campaign.

Negotiating the Deal

The benefits of most mineral developments depends on how well you negotiate.

Lack of information is the biggest problem when negotiating an effective deal with a developer. The more you know about current markets, the metallic minerals business, departmental and legal requirements, the needs of a band and the situation of the developer, the better equipped you will be to get a sound agreement.

Contact DIAND business and resource advisors for assistance and ask questions of people in the business.

Conclusion

This booklet tracks the issues of mineral exploration and development by flagging each stage at which decisions can be made to proceed or abandon the process. Some of the decision-making tools are a development policy, a clear understanding of the mineral disposition rights process, a full understanding of the exploration and development business including its costs, a full understanding of the environmental risk, and a mineral implementation strategy if you decide to proceed.

The process starts with a basic decision: Do you want expanded economic development of any kind for your First Nation? If so, what kind? If your choice is mineral and mining, the next stage is to surrender your mineral rights to allow exploration. The developer establishes the presence, quantity, quality and accessibility of minerals on your land. Like a series of forks in the road, the results of each exploration stage lead either to a more detailed investigation or a decision to go no further, culminating in the building of a mine. All along the road, the First Nation must measure the benefits of jobs, training, new infrastructure, royalty and surface rent income against the possible costs of dead-end investigation, environmental problems and diminished privacy on the reserve. The decisions are yours. They are easier to make based on information on every stage of the process.

GLOSSARY

Adit - An opening driven horizontally into the side of a mountain or hill for providing access to a mineral deposit.

Airborne survey - A survey made from an aircraft to obtain photographs, or measure magnetic properties, radioactivity, etc.

Alloying agent - An element which aids in making alloys.

Alloys - a compound of two or more metals, e.g., bronze (tin and copper).

Anomaly - Any departure from the norm which may indicate the presence of minerals in the underlying bedrock. In geophysics and geochemistry, an area where the property being measured is significantly higher or lower than the larger, surrounding area.

Assay - An analysis of a collected mineral sample or specimen to identify and measure the presence of base and/or precious metals. Typically recorded in ounces per ton, or grams per tonne of specific metals, i.e., gold, silver, copper, zinc, etc.

Assessment work - the work that must be performed each year to retain legal control under the *Indian Mining Regulations*. The work must be equivalent to a certain value. Where the work done does not meet the required value, cash may be paid in lieu of the balance of the work.

Base metals - Non-precious metals, e.g., iron, copper, lead, zinc, etc. (see **Precious metals)**

Bedrock - Solid rock forming the earth's crust, frequently covered by soil or water.

Beneficiate - To concentrate or enrich; often applied to the preparation of iron ore for smelting, through such processes as magnetic concentration, washing, etc.

Brunton compass - A pocket compass equipped with sights and a reflector, useful for sighting lines, measuring dips and carrying out preliminary surveys.

Concentrator - A milling plant that produces a concentrate of the valuable minerals or metals. Further treatment is required to recover the pure metal.

Consolidated minerals - A massive or solid stone or other mineral deposit that must be cut, blasted or loosened by some method to be mined, e.g., limestone, granite, shale, etc. (see **Unconsolidated minerals**)

Deposit - A mass of naturally occurring mineral material, usually of economic value, without regard to mode of origin. Even such organic fuels as coal and petroleum are sometimes called mineral deposits.

Development (mining) - The sinking of shafts and tunnels into a mineral deposit for the purpose of more detailed and accurate exploration, conducted before the decision to start actual mining.

Diamond drill - A rotary type of rock drill in which the cutting is done by abrasion rather than percussion. The cutting bit, set with diamonds, is attached to the end of long hollow rods through which water is pumped to the cutting face. The drill cuts a core of rock that is recovered in long cylindrical sections, two centimetres or more in diameter.

Dore bar - the final saleable product of a gold mine.

Drift - A horizontal underground opening that follows along the length of a vein or rock formation as opposed to a crosscut which crosses the rock formation.

Dyke - A crosscutting rock unit that is younger than the rocks it intrudes.

EM survey - A geophysical survey method which measures the electromagnetic properties of rocks.

Environmental impact study - A written report, compiled prior to a production decision, that examines the effects proposed mining activities will have on the natural surroundings of an exploration property.

Erosion - The breaking down and subsequent removal of either rock or surface material by wind, rain, wave action, freezing and thawing and other processes.

Exploration - The various activities applied in the search for a deposit of minerals suitable for commercial extraction, e.g., prospecting, sampling, mapping, diamond drilling, etc.

Federal/provincial mineral agreement - An agreement between the federal government and a province concerning the ownership and disposition of minerals underlying reserve lands.

Geochemistry - The study of the chemical properties of rocks.

Geophysics - The study of the physical properties of rocks and minerals.

Geophysical survey - A scientific method of prospecting that measures the physical properties of rock formations. Common properties investigated include magnetism, specific gravity, electrical conductivity and radioactivity.

Gossan - The rust-coloured oxidized capping or staining of a mineral deposit, generally formed by the oxidation or alteration of iron sulphides.

Grab sample - A sample taken at random; it is assayed to determine if valuable elements are contained in the rock. A grab sample is not intended to be representative of the deposit, and usually the best-looking material is selected.

Greenstone - Generalized name given to Precambrian lavas.

Gross value - The theoretical value of ore determined simply by applying the assay of metal or metals and the current market price; it represents the total value of the contained metals before deduction for dilution, mill recovery losses, mining and smelting costs, etc.; it must be used only with caution and severe qualification.

Hoist - The machine used for raising and lowering the cage or other conveyance in a shaft.

Host rock - The rock surrounding an ore deposit.

Igneous - Rock or mineral that solidified from molten or partly molten material.

Industrial minerals - Non-metallic, non-fuel minerals used in their natural state in the chemical and manufacturing industries; they require some beneficiation. Examples are asbestos, gypsum, salt, graphite, mica, gravel, building stone, talc.

Intrusion - A mass of igneous rock formed by the consolidation of magma intruded into other rocks, in contrast to lavas, which are extruded upon the surface.

Invitation to tender - An advertisement placed by a First Nation or DIAND, requesting bids for permits to prospect or for mineral leases.

Lease - A document that grants the lessee a property interest in land or minerals, with an exclusive right to occupy the land or to mine the minerals.

Level - The horizontal openings on a working horizon in a mine. It is customary to work mines from a shaft, establishing levels at regular intervals, generally about 50 metres or more apart.

Magnetometer - An instrument used to measure the magnetic attraction of underlying rocks.

Metallic minerals - Minerals which either present a metallic shine or lustre in their appearance, or contain metals in their chemical composition, making them a potential source of the metal through mining. Examples include pyrite, bornite, galena. (see **Non-metallic minerals**)

Mill - 1) A plant in which ore is treated for the recovery of valuable metals, or the concentration of valuable minerals into a smaller volume for shipment to a smelter or refinery. 2) A piece of milling equipment consisting of a revolving drum, for the fine-grinding of ores as a preparation for treatment.

Mineral lease - A document issued under the *Indian Mining Regulations* that grants a right to explore for, develop and produce minerals within the lease area.

Minerals - Naturally occurring substances with specific chemical compositions, e.g., quartz, feldspar, pyrite, etc. The *Indian Mining Regulations* contain the following definition: "naturally occurring metallic and non-metallic minerals and rock containing such minerals, but does not include petroleum, natural gas and other petroliferous minerals or any unconsolidated minerals such as placer deposits, gravel, sand, clay, earth, ash, marl and peat."

Mineral occurrence - A place, site or deposit, of which little may be known, except that specific minerals have been identified and recorded.

Net profit interest - Profit remaining after all charges, including taxes and bookkeeping charges (such as depreciation) have been deducted.

Net smelter return - An interest in a mining property held by the vendor on the net revenues generated from the sale of metal produced by the mine.

Non-metallic minerals - Minerals which either present a non-metallic shine or lustre in their appearance, such as glassy or ceramic, or do not contain extractable metals in their chemical composition, e.g., limestone, quartz, feldspar, argillite. (see **Metallic minerals**)

Nugget - A small mass of precious metal, found free in nature.

Open pit - A surface mine, open to daylight, such as a quarry. Also referred to as open-cut or open-cast mine.

Orebody - A body of minerals known and proven to occur in a quantity and quality economically viable for mining.

Ore reserves - The calculated tonnage and grade of mineralization which can be extracted profitably; classified according to the level of confidence that can be placed in the data. Proven ore reserves, for example, are ore reserves that have been sampled extensively by closely spaced diamond drill holes and developed by underground workings in sufficient detail to allow an accurate estimation of grade and tonnage. *Probable* and *possible ore reserves* represent mineralization whose tonnage and grade cannot be accurately estimated because not enough samples have been taken.

Outcrop - An exposure of rock or mineral deposit that can be seen on the surface, i.e., that is not covered by overburden or water.

Permit - A document that grants the holder a personal interest in land or minerals, with a non-exclusive right of access and use. Permits do not grant a property interest.

Permit to prospect - A document issued under sections 5 or 6 of the *Indian Mining Regulations* after receipt of tenders or upon application. The permit to prospect grants the holder a non-exclusive licence to explore for and to develop minerals within a permit area. A permit to prospect does not grant an interest in land and does not grant the holder the right to produce minerals.

Placer - A mineral deposit usually formed by rivers and streams which concentrate the heavy mineral particles such as gold.

Precambrian - The earliest part of the geological time scale, including all corresponding rocks, equivalent to about 90 percent of geologic time; from the beginning of time until the beginning of the Paleozoic, about 600 million years ago.

Precious metals - A term with historical and scientific applications, generally used to describe those metals having value as currency or jewellery, e.g., gold, silver, platinum, palladium. (see **Base metals**)

Profit and loss statement - The income statement of a company, detailing revenues minus total costs to give total profit.

Prospect - A mining property, the value of which has not been proven by exploration.

Quartz - Common rock-forming mineral consisting of silica and oxygen.

Rent - A fee charged to a holder of a permit or lease for the use of the land surface in the permit or lease area. Rental rates may be specified in regulations but are more usually negotiated between the permit or lease holder and the Crown, in which case the rates are specified in the permit or lease. Rents should reflect fair market value and are normally reviewable during the term of the permit or lease.

Reserve - Land, the legal title to which remains vested in the Crown and which is set apart for the use and benefit of a band. Reserves include "designated lands."

Rock - A naturally occurring material composed of one mineral or, more often, a combination of minerals naturally hardened and consolidated into a solid mass.

Royalties - A payment by a lease holder of minerals to the owner of minerals, usually expressed as a percentage of the production sold. Royalties are paid on metallic minerals and are collected by the Crown on behalf of the band.

Sample - A small portion of rock or a mineral deposit, taken so that the metal content can be determined by assaying.

Sandstone - A sedimentary rock consisting of grains of sand cemented together.

Security fee - A payment made to DIAND by a permit or lease holder to cover possible damage to land, livestock or structures that may not be repaired by the permit or lease holder. A security fee may also be required to cover reclamation costs.

Sedimentary rocks - Secondary rocks formed from material derived from other rocks and laid down under water, e.g., limestone, shale and sandstone.

Shaft - A vertical or inclined excavation for the purpose of opening and operating a mine. It is usually equipped with a hoist at the top which raises and lowers the cage and skip. A shaft may also be used for ventilating underground workings.

Skip - A container to haul rock from a mine.

Stope - An underground excavation formed by working in a series of steps when mining a vertical orebody.

Strike - The direction, or bearing, from true north of a vein or rock formation measured on a horizontal surface.

Surface lease - A lease issued under section 53(1) of the *Indian Act*, which grants the lessee the right to place permanent installations on the surface. This lease may be required by a mineral lessee to use the surface extensively.

Tailings - Material rejected from a mill after most of the recoverable valuable minerals have been extracted.

Tailings pond - A low-lying depression used to confine tailings, the prime function of which is to allow enough time for heavy metals to settle out or for cyanide to be destroyed before water is discharged into the watershed.

Trench - A long, narrow excavation dug through overburden, or blasted out of rock, to expose a vein or ore structure.

Unconsolidated minerals - Loose, soft or granular materials found in deposits that can be excavated easily without cutting or blasting to be mined, e.g., sand, gravel, clay, etc. (see **Consolidated minerals**)

Vein - A fissure, fault or crack in a rock filled by minerals that have travelled upwards from some deep source.

Venture capital - Money to be spent on a business or mineral development project. As an investor, you are able to share in the profits.

Appendix A

Names and Addresses of Provincial Government Geological Agencies

The reader is advised to verify the phone numbers of the Provincial government geological agencies as the numbers may change frequently.

British Columbia
Ministry of Energy, Mines and Petroleum Resources
Geological Survey Branch
Chief Geologist's Office
553 Superior Street
Victoria, B.C.
V8V 1X4
(604) 387-0687

Alberta
Alberta Department of Energy
Mineral Resource Division
9915-108 Street
Edmonton, Alta.
T5K 2C9
(403) 427-7749

Saskatchewan
Saskatchewan Energy and Mines
Geology and Mines
1914 Hamilton Street, 12th Floor
Regina, Sask.
S4P 4V4
(306) 787-2560

Manitoba
Manitoba Energy and Mines
Geological Section
Eaton Place
535-330 Graham Avenue
Winnipeg, Man.
R3C 4E3
(204) 945-6567

Ontario
Ontario Geological Survey
Geoscience Branch
Willet Green Miller Centre
933 Ramsey Lake Rd.
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Nova Scotia Department of Natural Resources
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(902) 424-4162

Prince Edward Island
Prince Edward Island Department of
Economic Development and Tourism
Energy Branch
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Newfoundland
Newfoundland and Labrador Department
of Mines and Energy
Geological Survey Branch
95 Bonaventure Avenue
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Atlantic Geoscience Centre
Bedford Institute of Oceanography
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Dartmouth, Nova Scotia
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Tel.: (902) 426-3410

Appendix B

Additional Reading

Mining Explained
A Guide to Prospecting and Mining
Northern Miner Press Inc.
(416) 368-3481